BUILDING SERVICES I

LIGHTING & ACOUSTICS

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BUILDING SERVICES

- Building Services = systems that make buildings habitable, comfortable, safe.

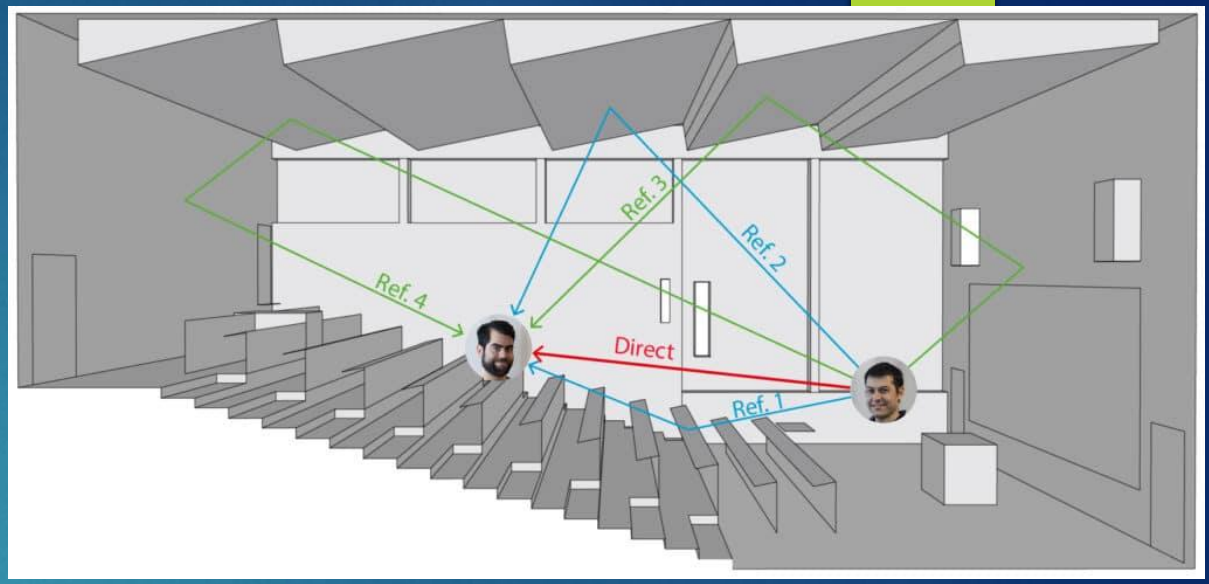
- **Architect's role**: allocate spaces, coordinate with engineers, supervise workers

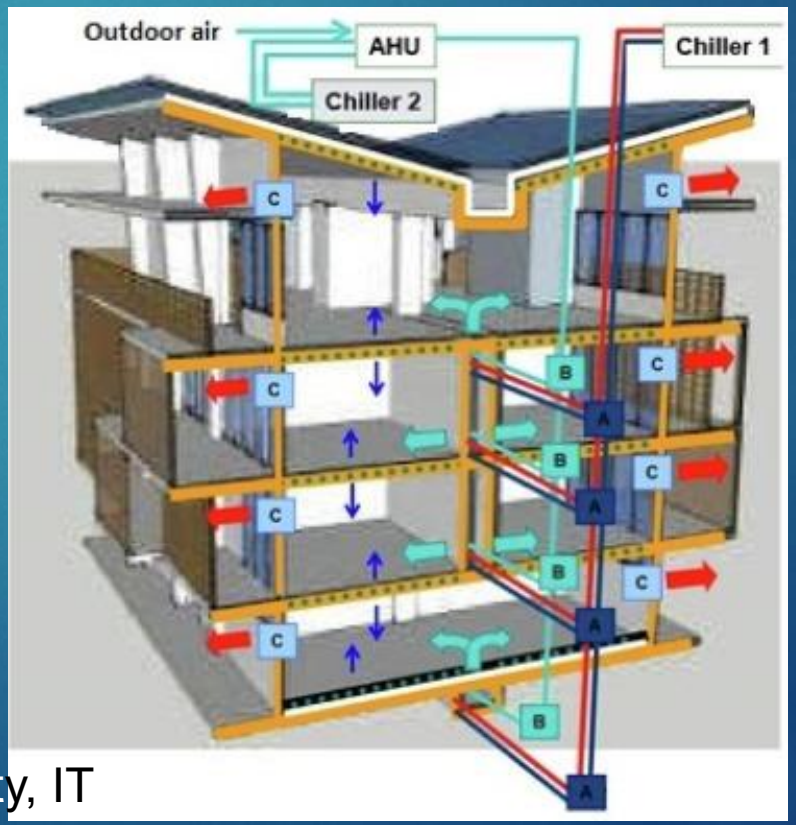
Main families of services:

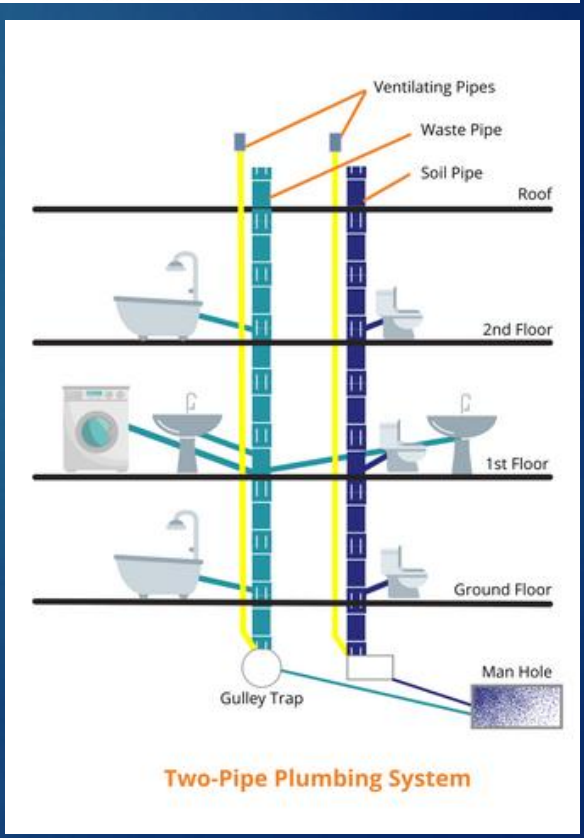
Lighting & Acoustics – *this semester*

Sanitary Systems – *next semester*

HVAC Systems – *following semester*





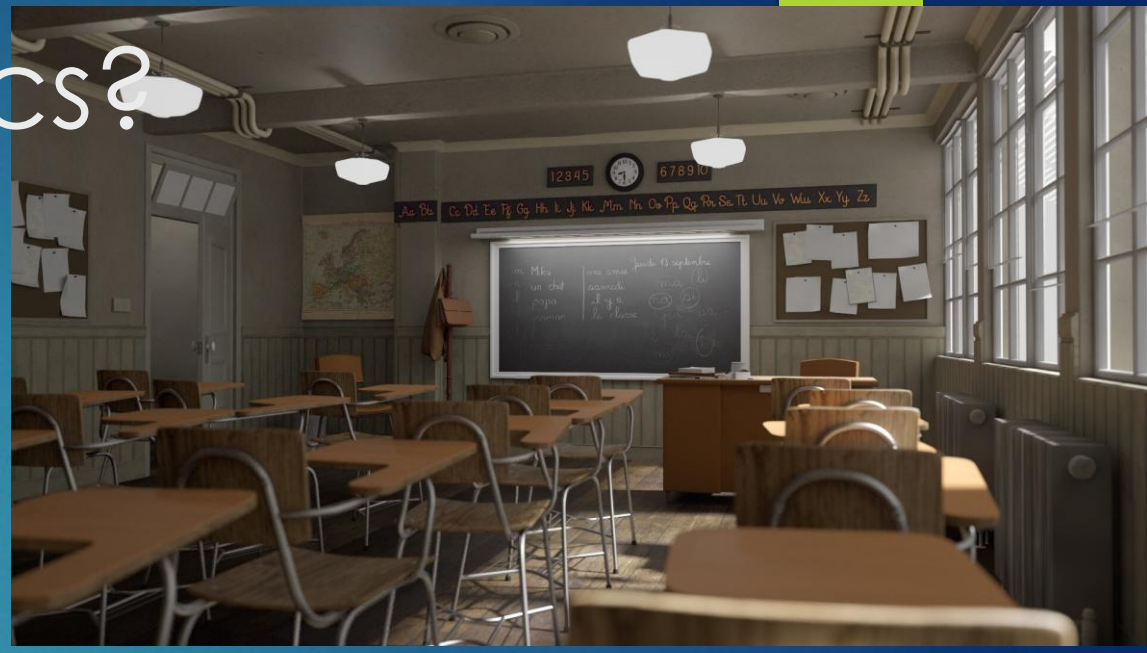


•Other services: lifts, escalators, fire protection, security, IT

Why Lighting & Acoustics?

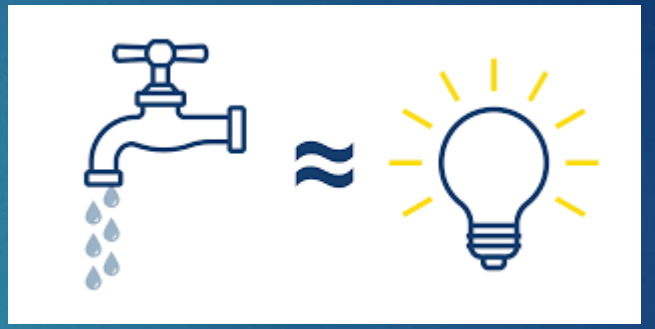
Direct impact on comfort & usability

- Lighting = visual comfort → ability to see, work, feel safe
- Acoustics = control of noise & reverberation → ability to concentrate, rest, communicate
- Both are **"invisible architecture"** → not always seen, but always felt

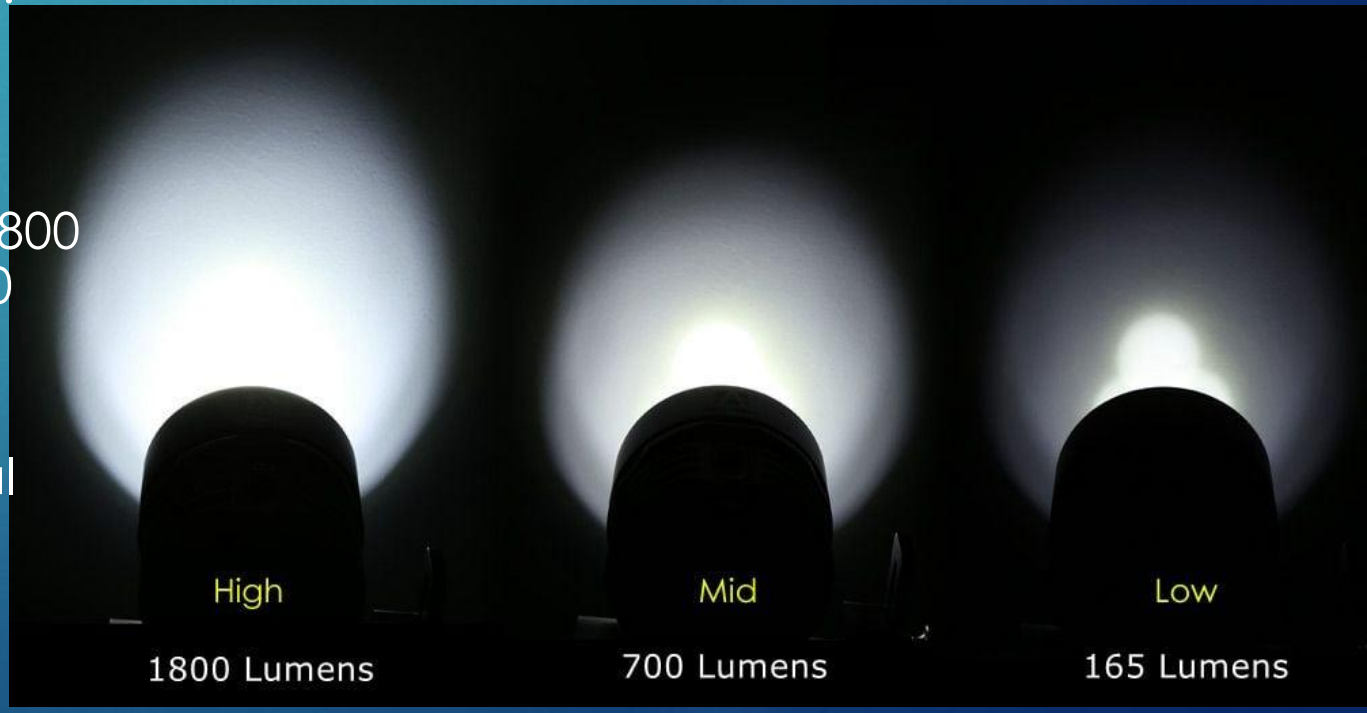


Lighting: Basic Concepts
Lighting Units

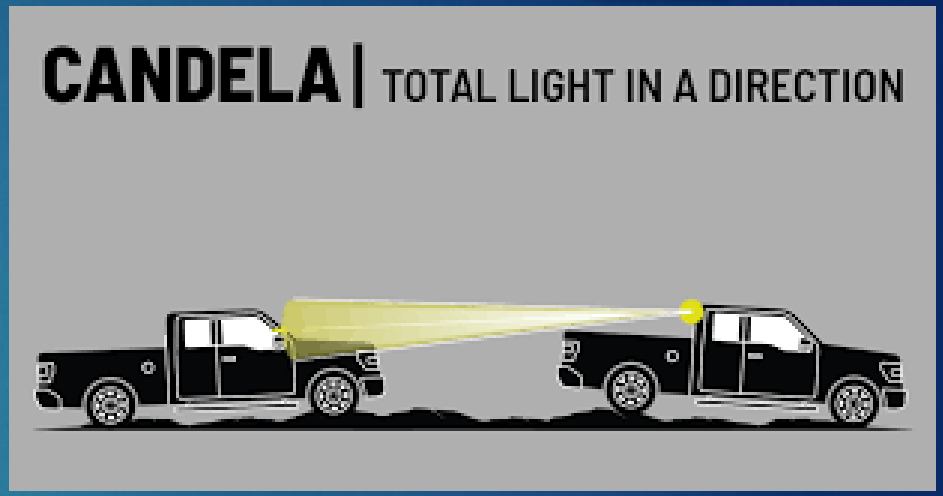
1. Lumen (lm)



- "A **lumen** is the unit of **luminous flux**. It measures the total amount of light emitted by a source in all directions. Think of it as the **quantity of light leaving a lamp**."
- *Example:*
  A standard LED bulb may produce 800 lumens. A stronger one can be 1500 lumens.
- *Analogy:* Like the amount of water flowing out of a tap — lumen = total flow of light.



Lighting: Basic Concepts
Lighting Units



2. Candela (cd)

- *Definition:*
  "A **candela** is the unit of **luminous intensity**.

It tells us how strong the light is in a particular **direction**."

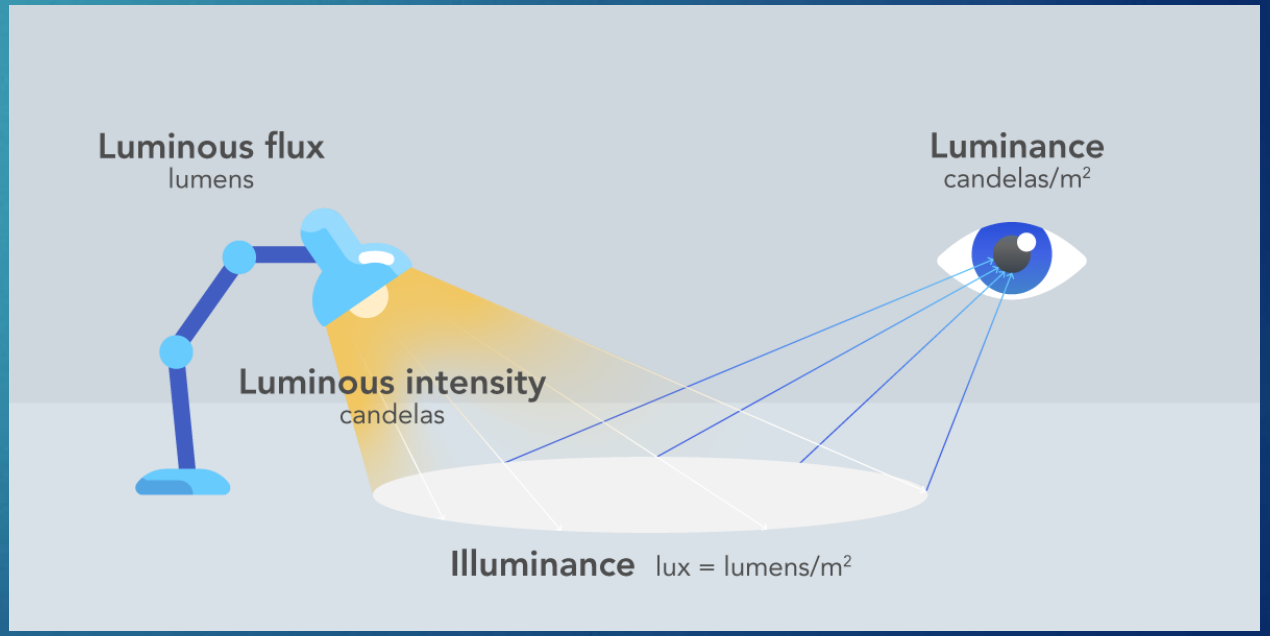
- *Example:*
  A focused spotlight might have a high candela value because its light is intense in one direction, even if its total lumens are not very high.
- *Analogy:* Like water from a hose: if you focus the spray into a jet, its intensity in one direction increases.

Lighting: Basic Concepts
Lighting Units

3. Lux (lx)

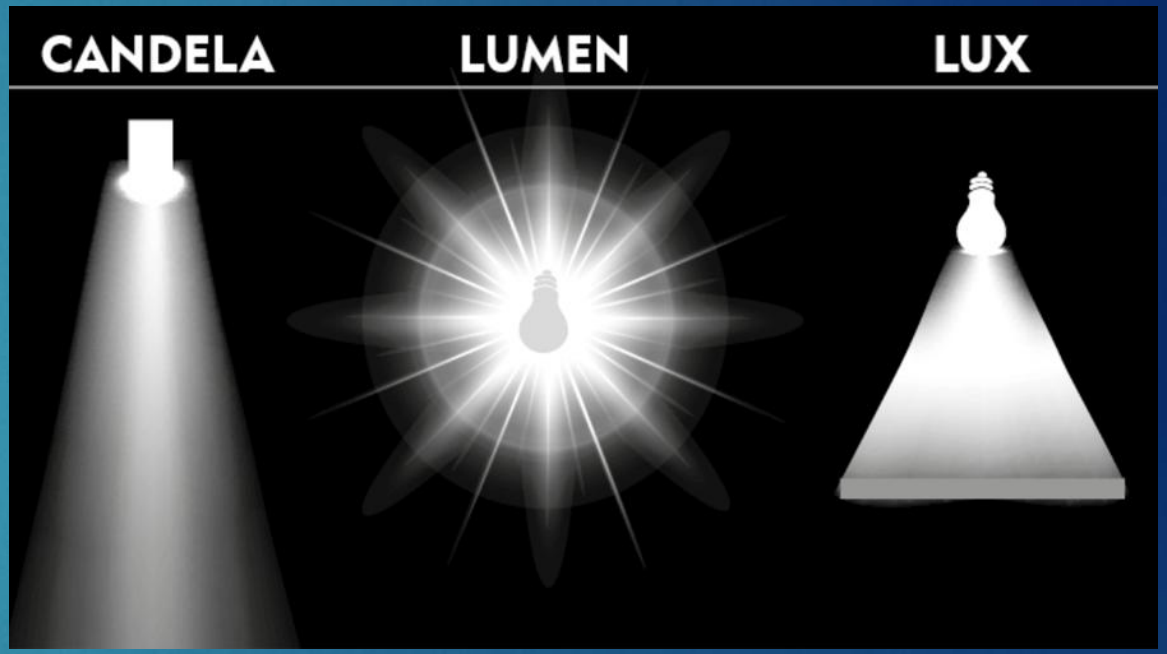
- *Definition:*
  "**Lux** is the unit of **illuminance**. It tells us how much light actually falls on a surface. One lux = one lumen per square meter."
- *Example:*
  A classroom should have around 300–500 lux on the desks.
  A corridor needs only about 100 lux.

- *Analogy:* If lumens are the total water from a tap, lux is how much water covers a square meter of the floor.



Lighting: Basic Concepts
Lighting Units

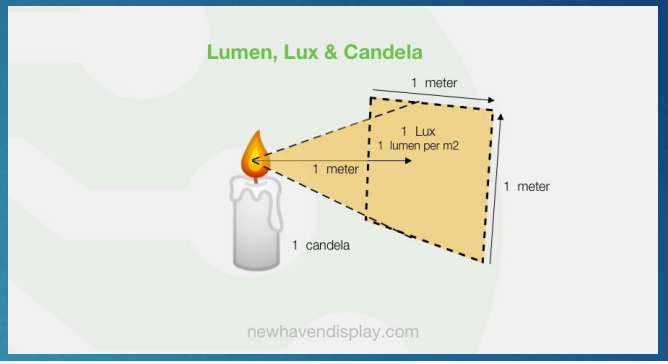
- **Lumen** = total light output of the lamp.
- **Candela** = light intensity in a direction.
- **Lux** = light received on a surface.

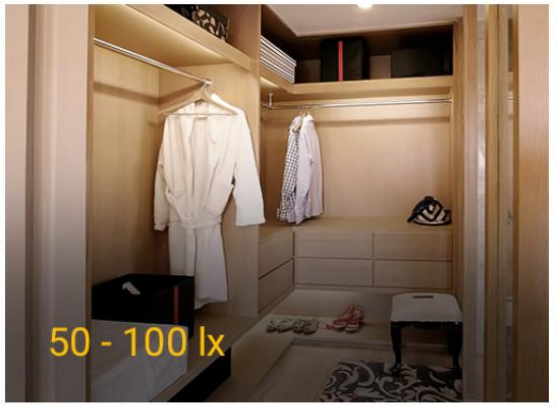


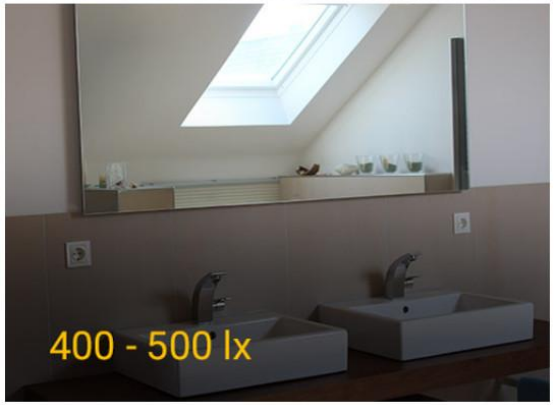
- *Architect's practical takeaway:* You don't just buy lamps by watts anymore — you must look at **lumens (output)** and design for **lux (on surfaces)**.

Lighting: Basic Concepts
Light Intensity

- **Light Intensity** → measured in *lux*
  - Classroom: 300–500 lux
  - Corridor: ~100 lux

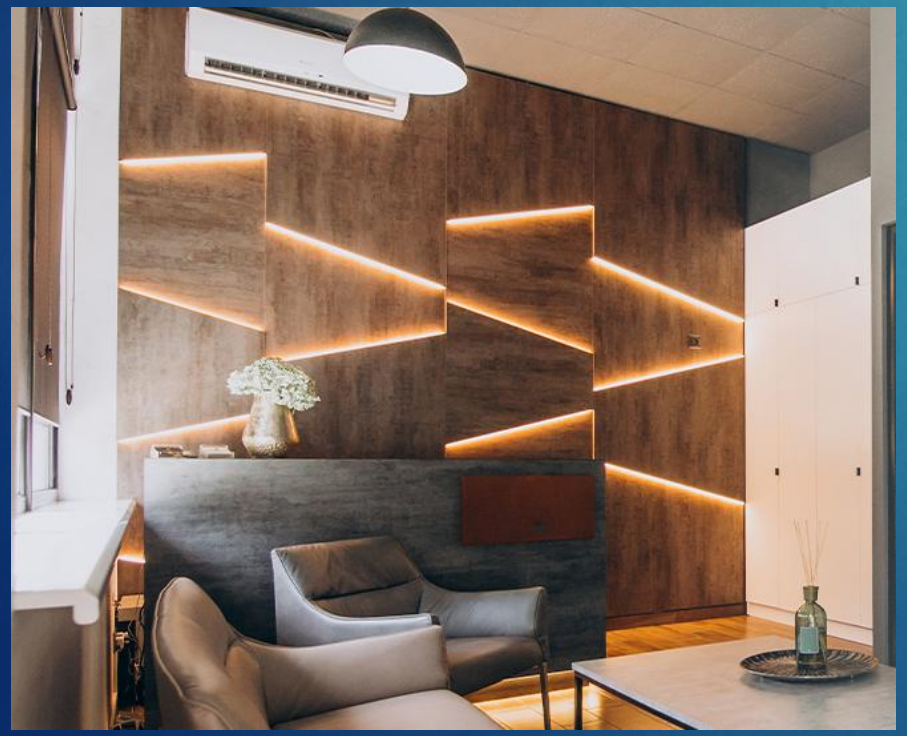






Lighting: Basic Concepts
Light Direction

- **Light Direction** → side, top, reflected



Lighting: Basic Concepts
Color Temperature

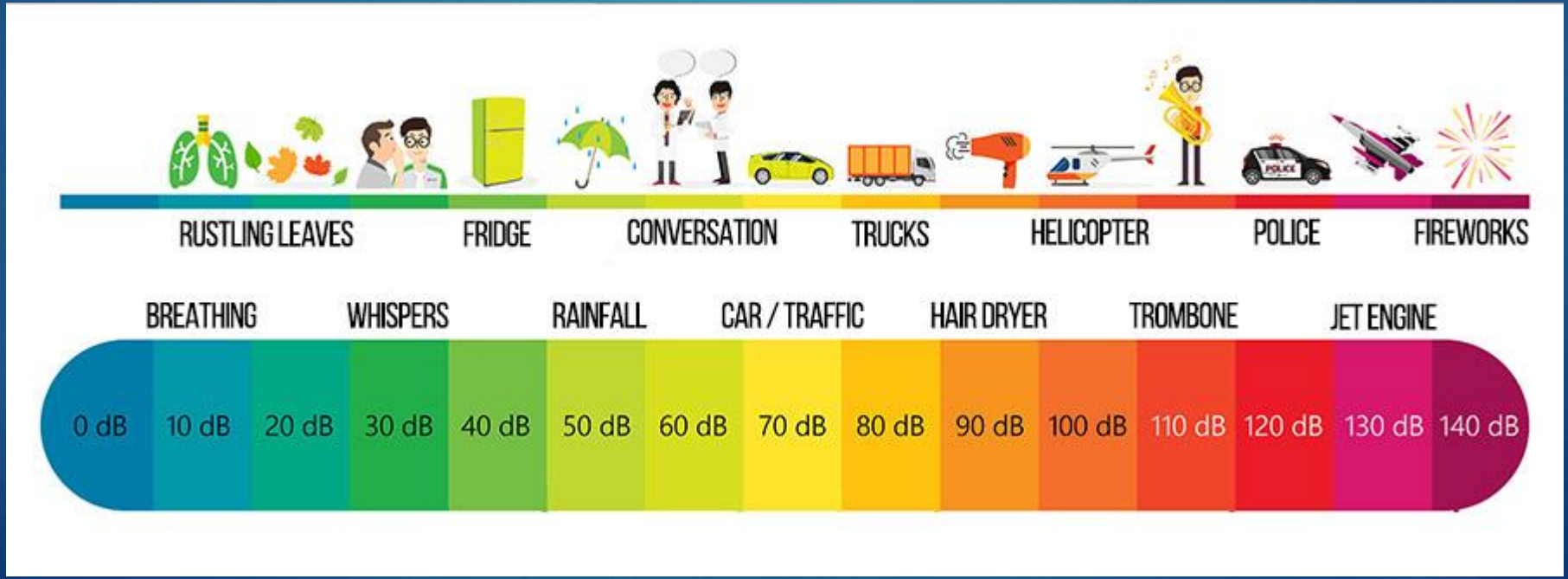
Color Temperature (Kelvin):

- Warm (2700K) = cozy
- Neutral (4000K) = balanced
- Cool (6000K) = alert, energetic

Acoustics: Basic Concepts

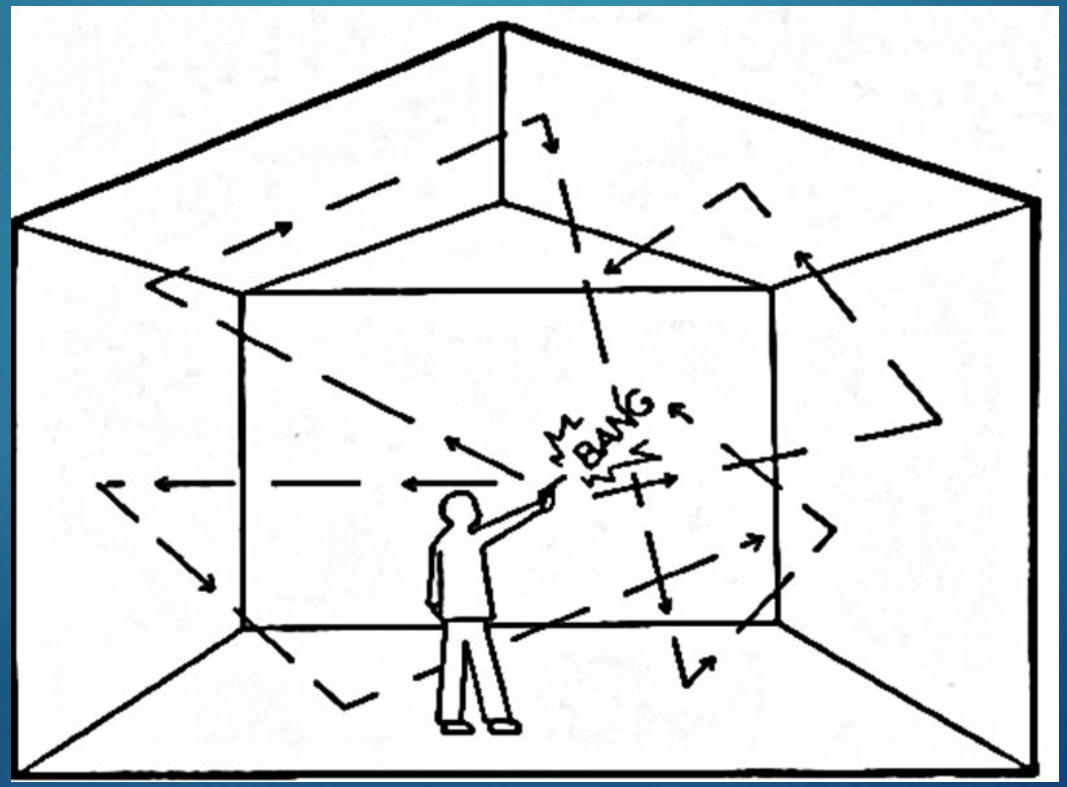
Sound properties:

- *Decibel (dB)* = loudness (conversation ~60 dB, >85 dB harmful)
- *Frequency (Hz)* = pitch (low = bass, high = sharp noise)



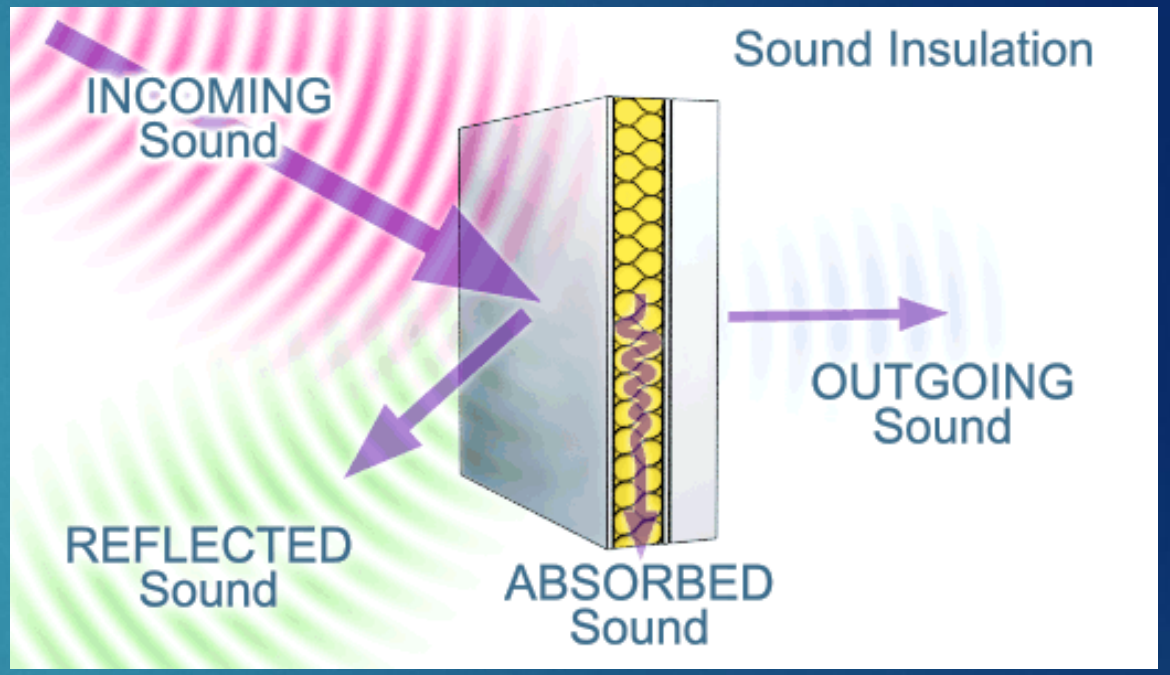
Acoustics: Basic Concepts

- **Reverberation** = persistence of sound (echo) in a room



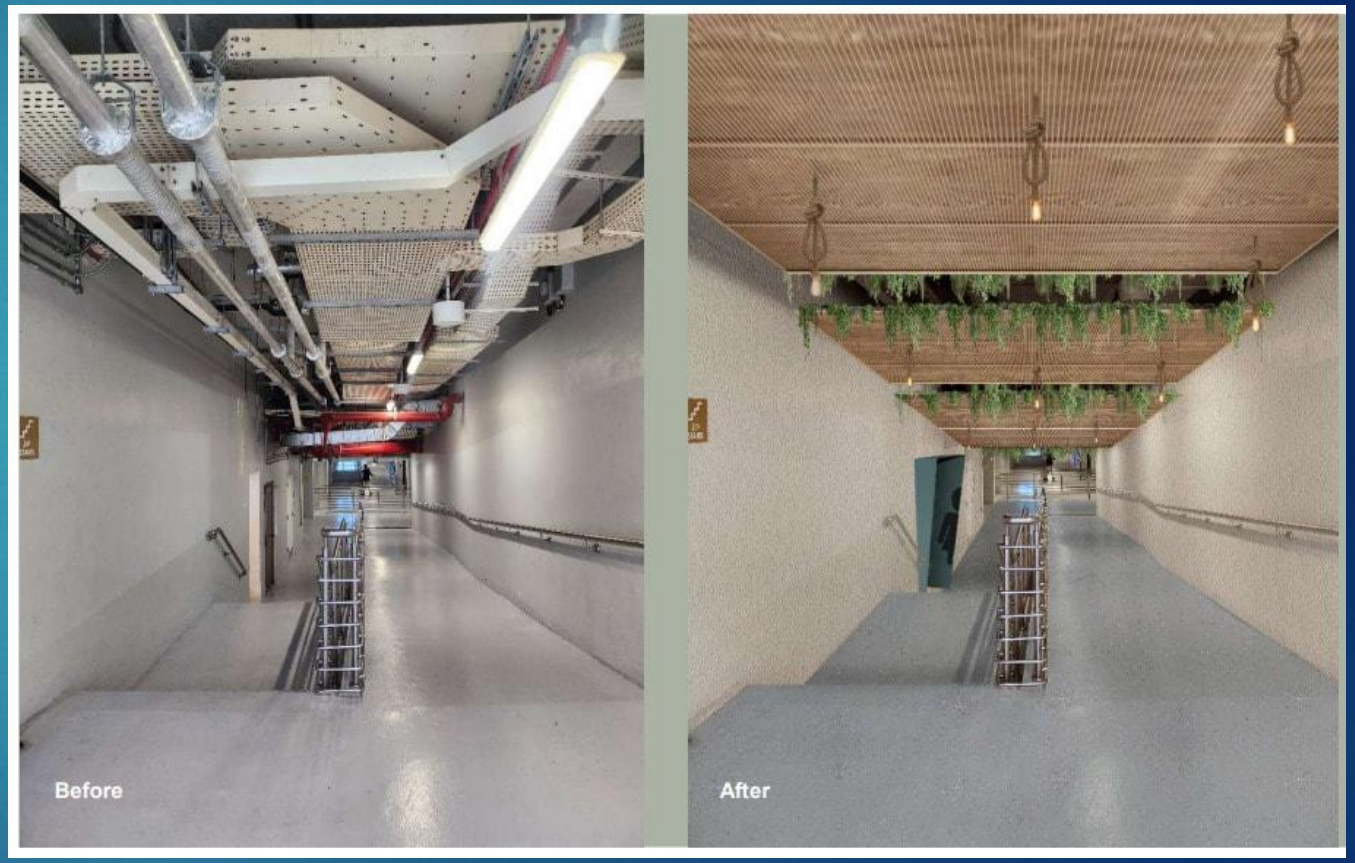
Acoustics: Basic Concepts

- **Architectural materials:**
  - Absorption → acoustic panels, carpets
  - Reflection → glass, concrete
  - Diffusion → angled/curved surfaces



Relationship to Other Services

- **Lighting** ↔ **Electrical** → needs wiring, DB, emergency backup
- **Acoustics** ↔ **HVAC** → ducts transmit noise, fans cause vibration
- **Crowded ceiling spaces:** lighting + ducts + sprinklers + acoustic panels
- **Architect's task:** design ceiling & voids for neat integration



Case Example: Lecture Hall

- Lighting → avoid glare on screen, provide even light
- Acoustics → panels for clarity, control of reverberation
- HVAC → air diffusers positioned to avoid drafts
- All systems integrated in ceiling design

Course Roadmap

- Weeks 2–6 → Lighting
- Week 7 → Midterm
- Weeks 8–12 → Acoustics
- Weeks 13–14 → Integration & case studies
- Week 15 → Revision
- Week 16 → Final Exam

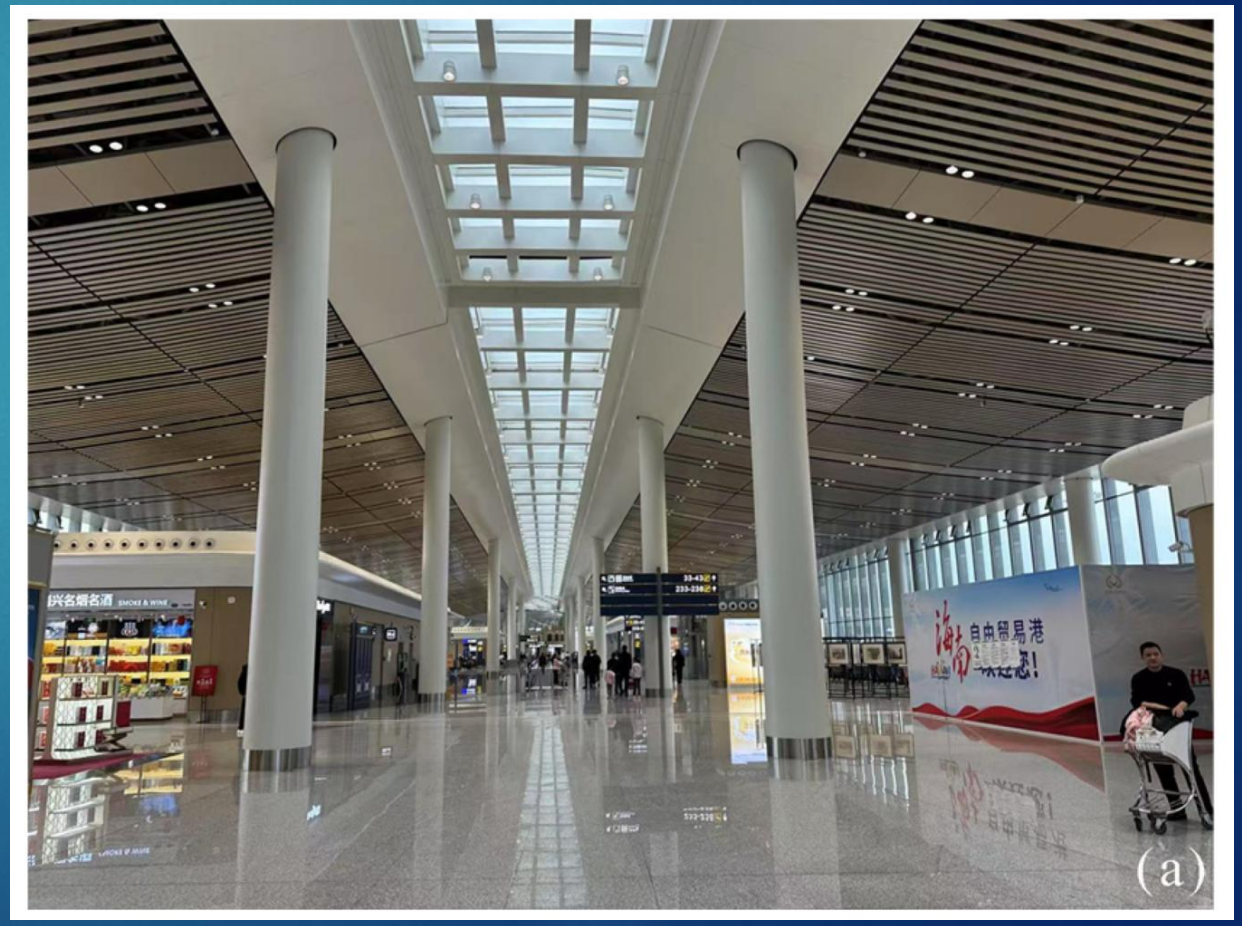
Learning Outcomes (for exam focus)

By end of this semester, students should:

- Understand principles of lighting & acoustics
- Use correct technical terms with engineers
- Supervise workers & spot mistakes in site execution

Class Activity

- **Question:** In these spaces (library, airport, hospital ward):
- Identify **two lighting aspects**
- Identify **two acoustic aspects**



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Thank You!

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